

REMARKS

Claims 1-65 are currently pending in this application. Claims 1-4, 7-15, 18-25, 28, and 30 have been amended to more appropriately define the present invention. Claims 31-65 have been added to provide additional protection to the invention. Applicants respectfully request the Examiner to reconsider and withdraw the outstanding rejections presented in the Office Action in light of the Remarks and Amendments presented herein.

Objections to the Specification

The Examiner objected to the specification because of a number of grammatical informalities. Applicants have amended the specification to address the informalities cited by the Examiner. Applicants respectfully request the objections to the specification be withdrawn.

Claim Objections

The Examiner objected to claim 2 alleging it contained informalities. The Examiner alleges that the recitation in claim 2 at line 1, "comprising the step," is objectionable because it is "not clear the steps are referring to which limitation in claim 1." (Office Action: line 2, paragraph 5, lines 2-3). Applicants do not necessarily agree with this objection, because subsequent steps could be added in a dependent claim which are provided in addition to the limitations of the corresponding base claim (i.e., a subsequent limitation in a dependent claim does not necessarily have to refer to a limitation in a previous base claim). However, in this case, Applicants have amended claims 1 and 2 to more clearly define the invention.

Explanation of an Embodiment of the Invention

As a convenience to the Examiner, Applicants provide herewith a summary of an embodiment of the invention. In this embodiment, apparatus and methods are presented for identifying a virtual raster pattern, or a coordinate reference, in an image in order to identify two-dimensional positions on a surface, even when the raster pattern is not visible and represented solely by positional offset patterned elements. The embodiment of the invention may identify the virtual raster pattern in an image which is recorded with an unknown rotation and/or, an unknown perspective between the imaging sensor and the image surface.

Images of the surface may need compensation for various distortions caused by the relative geometry between the surface, virtual raster pattern, and the sensor capturing the image. According to an embodiment of the invention, the image processing may be divided into a number of main categories, including:

1. preprocessing of the image to identify all of the marks contained therein,
2. detection of the images main vectors via Fourier analysis,
3. compensation for unknown rotations in the image plane,
4. detection and compensation for unknown perspective,
5. detection and compensation for unknown displacements (E.g., see specification: page 19, second paragraph; Figure 2).

1. Preprocessing

The purpose of preprocessing includes identifying all of the marks in the image. This can be performed in a variety of ways known to those of ordinary skill in the art, one technique may include identifying groups of pixels which exceed a preset threshold value. Once a group of pixels have been identified as a mark, the center of gravity may be calculated for such pixels belonging to the mark and used in subsequent processing. The image may then be converted to a set of dots by replacing each of the identified marks with unit impulses, each being placed at the centers of gravity of the marks.

2. Detection of Main Vectors

Detection of main vectors may be performed to establish the dominant directions and the dominant spatial frequencies in the image. This may be carried out by calculation of the Fourier transform of the set of dots for different direction vectors (E.g., see specification: page 21, fourth and fifth paragraph). The half plane in the Fourier domain is searched for each dot frequency representing an ensemble of dots to establish a set of candidate vectors. Once the candidate vectors established, the main vectors may be determined from the set of candidate vectors by examining their relative geometric relationships. However, this may not apply in the general case when the image has distortions, and a number of image transforms may be used to assist in determining the main vectors.

3. Compensation for Rotation

Once the main vectors in the image are determined, compensation for any unknown rotation may be performed. This can be accomplished by projecting the set of dots along the main vectors so the dots are principally aligned therewith (E.g., see specification: page 29, paragraphs 2 and 3; Figures 1b-before rotation, Figure 4-after rotation).

4. Detection and Compensation of Perspective

Once the image has been compensated for unknown rotations, it may then be compensated for unknown perspective distortion. This compensation can be performed through means of a perspective transformation (E.g., see specification: page 29, fourth paragraph through page 30). Prior to performing this transformation, the inclination of the raster pattern may be determined to quantify how the raster pattern varies along the main vectors of the image. The inclinations may be used in the perspective transform, which in turn can be applied to the image to correct the perspective distortion (E.g., see specification: page 32-33; Figures 6 and 7).

5. Detection and Compensation for Displacement

Once the image is compensated for perspective, the image may then be compensated for a constant displacement along the main vectors. The displacements readily may be measured as phase in the Fourier domain. The phase displacement along a respective main vector may be computed from the Fourier transforms phase angle which is given by the ratio of its real part and its imaginary part. The phase displacement is eliminated by phase transformation of the set of dots whereby a new projection is carried

out along the most recently determined main vectors (E.g., see specification: page 35, Figures 8 and 9).

Applicants submit the above description may apply to an embodiment of the invention, the processes described and their order of execution as described above are merely exemplary and are not intended to be limiting on the scope of the invention described in the claims.

Claim Rejections – 35 U.S.C. §112, first paragraph

The Examiner rejected claims 1-30 under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. The Examiner asserts that independent claims 1 and 26 are “not enabled because there are no positively recited steps being performed”. Applicants respectfully traverse the §112, first paragraph, rejection of these claims. Applicants submit the Examiner has failed to establish a *prima facie* case of nonenablement with respect to the disclosure of this patent application. In order to establish a *prima facie* case of nonenablement, the Examiner must present a rational basis as to why the disclosure does not teach the manner and process of making and using the invention, that corresponds in scope to the claimed invention, to one of ordinary skill in the art in the pertinent technology without undue experimentation, and dealing with subject matter that would not already be known to the skilled person as of the filing date of this application. In the rejection, the Examiner failed to provide any evidence from the specification supporting the basis for a §112, first paragraph, rejection of claims 1-30.

Applicants submit that the disclosure does enable claims 1-30. For example, with respect to independent claims 1 and 26, the specification plainly enables these claims as can be found, for example, on page 19, paragraph 2-page 20, paragraph 1, which, along with Figure 2, describe processing steps for an embodiment of the invention. These steps are further described in enabling detail, for example, on page 20, pages 21-22, 29-30, 34-35, etc.

Moreover, the Examiner's assertion with respect to claims 21 and 26 that there are no positively recited steps and that there is uncertainty as to where the preamble ends and the body of the claims begins, are not issues that would be addressed under the first paragraph of §112. Accordingly, Applicants respectfully request that the §112, first paragraph, rejection of claims 1-30 are withdrawn.

Claim Rejections – 35 U.S.C. §112, second paragraph

The Examiner rejected claims 1-30 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to point out and distinctly claim the subject matter of the invention. Applicants respectfully traverse the Examiner's rejection of these claims.

Applicants submit that the Examiner has failed to establish a *prima facie* case of indefiniteness under §112, second paragraph, because the Examiner did not provide sufficient reasoning as to why the claims are unclear when read in view of the specification. Additionally, the Examiner has failed to establish that one of ordinary skill in the art, when reading the claim in light of a specification, would not be able to ascertain with a reasonable degree of precision and particularity, the specific area set out and circumscribed by the claim.

Accordingly, Applicants respectfully request the Examiner to withdraw the §112, second paragraph rejections of claims 1-63.

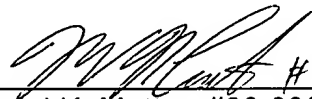
Conclusion

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael K. Mutter (Reg. No. 29,680) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By  #39,491
for Michael K. Mutter, #29,680

MKM/JAV/adt/apw
3782-0123P

P.O. Box 747
Falls Church, VA 22040-0747
(703) 205-8000

(Rev. 02/12/2004)